

What is claimed is:

1. A projection exposure apparatus which uses a mask including plural columns of a mask pattern for repeated exposure to a member to form plural columns of an exposure pattern thereon, comprising:
  - an illumination system which irradiates light to the mask;
  - a projection system which projects the light from the mask onto the member;
  - an exposure stage which moves the member;
  - a mask stage which moves the mask; and
  - a controller which controls light irradiation from the illumination system to the mask, driving of the exposure stage, and driving of the mask stage,  
wherein the controller alternately performs the light irradiation and step driving of the exposure stage for moving the member by a movement amount equal to  $n$  times a pitch of the columns of the exposure pattern (where  $n$  is a natural number smaller than the number of the columns of the mask pattern), and  
the controller performs step driving of the mask stage for moving the mask by a movement amount equal to  $n$  times a pitch of the columns of the mask pattern in association with step driving of the exposure stage in an early phase and a later phase of the repeated exposure.
2. The projection exposure apparatus according to claim 1, further comprising:
  - a light shielding member which shields light to prevent

light projection onto the member; and

a light shielding member stage which moves the light shielding member,

wherein the controller performs step driving of the light shielding member stage for moving the light shielding member by a movement amount corresponding to a pitch equal to n columns of the mask pattern in a light projection region on the member in association with step driving of the mask stage in the early phase and the later phase of the repeated exposure.

3. The projection exposure apparatus according to claim 1, wherein the mask includes plural columns of a first mask pattern for repeated exposure to the member to form plural columns of a discontinuous pattern thereon and a second mask pattern for exposure to the member to form a continuous pattern thereon.

4. The projection exposure apparatus according to claim 3, wherein the mask further includes a third mask pattern for exposure to the member to form a single pattern thereon.

5. The projection exposure apparatus according to claim 4, wherein the third mask pattern has a width which is a natural number multiple of a pitch of the columns of the first mask pattern.

6. A projection exposure apparatus which uses a mask including plural columns of a mask pattern for repeated exposure to a member

to form plural columns of an exposure pattern thereon, comprising:

an illumination system which irradiates light to the mask;

a projection system which projects the light from the illumination system onto the member;

an exposure stage which moves the member;

a light shielding member which shields light to prevent light projection onto the member from some of the plural columns of the mask pattern;

a light shielding member stage which moves the light shielding member; and

a controller which controls light irradiation from the illumination system to the mask, driving of the exposure stage, and driving of the light shielding member stage,

wherein the controller alternately performs the light irradiation and step driving of the exposure stage for moving the member by a movement amount equal to  $n$  times a pitch of the columns of the exposure pattern (where  $n$  is a natural number smaller than the number of the columns of the mask pattern), and

the controller performs step driving of the light shielding member stage for moving the light shielding member by a movement amount corresponding to a pitch equal to  $n$  columns of the mask pattern in a light projection region on the member in association with step driving of the exposure stage in an early phase and a later phase of the repeated exposure.

7. The projection exposure apparatus according to claim 6, wherein the mask includes plural columns of a first mask pattern

for repeated exposure to the member to form plural columns of a discontinuous pattern thereon and a second mask pattern for exposure to the member to form a continuous pattern thereon.

8. The projection exposure apparatus according to claim 7, wherein the mask further includes a third mask pattern for exposure to the member to form a single pattern thereon.

9. The projection exposure apparatus according to claim 8, wherein the third mask pattern has a width which is a natural number multiple of a pitch of the columns of the first mask pattern.

10. A method of projection exposure comprising the steps of:  
a first step of preparing a mask including plural columns of a mask pattern for repeated exposure to a member to form columns of an exposure pattern thereon; and

a second step of alternately performing light projection from the mask onto the member through light irradiation to the mask and step movement of the member for moving the member by a movement amount equal to  $n$  times a pitch of the columns of the exposure pattern (where  $n$  is a natural number smaller than the number of the columns of the mask pattern),

wherein, at the second step, the mask is moved in a step manner by a movement amount equal to  $n$  times a pitch of the columns of the mask pattern in association with the step movement of the member in an early phase and a later phase of the repeated

exposure.

11. The method of projection exposure according to claim 10, wherein, at the second step, a light shielding region is formed to prevent light projection onto the member from some of the plural columns of the mask pattern, and the light shielding region is moved in a step manner by a movement amount corresponding to a pitch equal to n columns of the mask pattern in a light projection region on the member in association with step driving of the mask in the early phase and the later phase of the repeated exposure.

12. The method of projection exposure according to claim 10, wherein the mask includes plural columns of a first mask pattern for repeated exposure to the member to form plural columns of a discontinuous pattern thereon and a second mask pattern for exposure to the member to form a continuous pattern thereon.

13. The method of projection exposure according to claim 12, wherein the mask further includes a third mask pattern for exposure to the member to form a single pattern thereon.

14. The method of projection exposure according to claim 13, wherein the third mask pattern has a width which is a natural number multiple of a pitch of the columns of the first mask pattern.

15. A method of projection exposure comprising the steps of:

a first step of preparing a mask including plural columns of a mask pattern for repeated exposure to a member to form plural columns of an exposure pattern thereon; and

a second step of alternately performing light projection from the mask onto the member through light irradiation to the mask and step movement of the member for moving the member by a movement amount equal to  $n$  times a pitch of the columns of the exposure pattern (where  $n$  is a natural number smaller than the number of the columns of the mask pattern),

wherein, at the second step, a light shielding region is formed to prevent light projection onto the member from some of the plural columns of the mask pattern, and the light shielding region is moved in a step manner by a movement amount corresponding to a pitch equal to  $n$  columns of the mask pattern in a light projection region on the member in association with step driving of the member in an early phase and a later phase of the repeated exposure.

16. The method of projection exposure according to claim 15, wherein the mask includes plural columns of a first mask pattern for repeated exposure to the member to form plural columns of a discontinuous pattern thereon and a second mask pattern for exposure to the member to form a continuous pattern thereon.

17. The method of projection exposure according to claim 16, wherein the mask further includes a third mask pattern for exposure to the member to form a single pattern thereon.

18. The method of projection exposure according to claim 17, wherein the third mask pattern has a width which is a natural number multiple of a pitch of the columns of the first mask pattern.

19. A method of manufacturing an exposed member, comprising the steps of:

a first step of preparing a mask including plural columns of a mask pattern for repeated exposure to a member to form plural columns of an exposure pattern thereon; and

a second step of alternately performing light projection from the mask onto the member through light irradiation to the mask and step movement of the member for moving the member by a movement amount equal to  $n$  times a pitch of the columns of the exposure pattern (where  $n$  is a natural number smaller than the number of the columns of the mask pattern),

wherein, at the second step, the mask is moved in a step manner by a movement amount equal to  $n$  times a pitch of the columns of the mask pattern in association with the step movement of the member in an early phase and a later phase of the repeated exposure.

20. The method of manufacturing an exposed member according to claim 19, wherein, at the second step, a light shielding region is formed to prevent light projection onto the member from some of the plural columns of the mask pattern, and the light shielding

region is moved in a step manner by a movement amount corresponding to a pitch equal to n columns of the mask pattern in a light projection region on the member in association with step driving of the mask in the early phase and the later phase of the repeated exposure.

21. The method of manufacturing an exposed member according to claim 19, wherein the mask includes plural columns of a first mask pattern for repeated exposure to the member to form plural columns of a discontinuous pattern thereon and a second mask pattern for exposing the member to form a continuous pattern thereon.

22. The method of manufacturing an exposed member according to claim 21, wherein the mask further includes a third mask pattern for exposure to the member to form a single pattern thereon.

23. The method of manufacturing an exposed member according to claim 22, wherein the third mask pattern has a width which is a natural number multiple of a pitch of the columns of the first mask pattern.

24. A method of manufacturing an exposed member, comprising the steps of:

    a first step of preparing a mask including plural columns of a mask pattern for repeated exposure to a member to form plural columns of an exposure pattern thereon; and

    a second step of alternately performing light projection

from the mask onto the member through light irradiation to the mask and step movement of the member for moving the member by a movement amount equal to  $n$  times a pitch of the columns of the exposure pattern (where  $n$  is a natural number smaller than the number of the columns of the mask pattern),

wherein, at the second step, a light shielding region is formed to prevent light projection onto the member from some of the plural columns of the mask pattern, and the light shielding region is moved in a step manner by a movement amount corresponding to a pitch equal to  $n$  columns of the mask pattern in a light projection region on the member in association with step driving of the member in an early phase and a later phase of the repeated exposure.

25. The method of manufacturing an exposed member according to claim 24, wherein the mask includes plural columns of a first mask pattern for repeated exposure to the member to form plural columns of a discontinuous pattern thereon and a second mask pattern for exposure to the member to form a continuous pattern thereon.

26. The method of manufacturing an exposed member according to claim 25, wherein the mask further includes a third mask pattern for exposure to the member to form a single pattern thereon.

27. The method of manufacturing an exposed member according to claim 26, wherein the third mask pattern has a width which is a natural number multiple of a pitch of the columns of the first

mask pattern.

28. A semiconductor device comprising:

columns of the exposure pattern formed through repeated exposure by using the projection exposure apparatus according to claim 1.

29. A semiconductor device comprising:

columns of the exposure pattern formed through repeated exposure by using the projection exposure apparatus according to claim 6.

30. A semiconductor device comprising:

columns of the exposure pattern formed through repeated exposure by using the method of manufacturing an exposed member according to claim 19.

31. A semiconductor device comprising:

columns of the exposure pattern formed through repeated exposure by using the method of manufacturing an exposed member according to claim 24.